Study to Determine the Common Substances that Caused Deaths due to Ingestion brought for autopsy in Tertiary Care Hospital, Hyderabad, Telangana, India

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ABSTRACT

Backgound: This study was conducted to know the common substances that caused deaths by ingestion, brought for autopsy to Osmania General Hospital, Hyderabad, Telangana State, India for a period three years. The cases of deaths due to poisoning were selected from the autopsies conducted and analyzed for the most commonly ingested substance.

Material and methods: The samples were collected for three consecutive years from January 2012 to December 2014. The contents of the stomach were examined grossly and the samples were collected in three containers during autopsy for each individual case. Portion of stomach and its contents, portions of liver, kidney, blood and body fluids were collected labeled and sent to the State Forensic Science Laboratory for analysis of unknown poison. The reports were analyzed. The data collected was arranged according to age, sex and substances detected.

Results: A total of 1196 cases of poisoning in three years were studied**.** Most of the deaths occurred, were due the ingestion of Organophosphates. It is the commonest insecticide used by farmers in fields. The common age group involved is between 21 years to 30 years ingesting organophosphates. In the deaths due to poisonings, men are predominantly involved compared to women.

Conclusion: In the study it was concluded that the ingestion of poisonous substance organophosphate is usually intentional and is used to commit suicide. In children it is mostly accidental. Poison can also be used as homicide to kill a person.

Key words: Forensic Science Laboratory; Organophosphate; Poison.

INTRODUCTION

This study was conducted to know the common substances that caused deaths by ingestion. Of the cases brought for autopsy to mortuary of Osmania General Hospital, Hyderabad, Telangana State, India, for a period of three years, the cases of deaths due to poisoning were selected and analyzed for the most commonly used substance.

A poison is any substance that on introduction into the living body or on bringing into contact with any part thereof will produce ill effects or death by its local or systemic action or both. In fact, every substance is theoretically capable of producing toxicity and every drug is potentially a poison when used erratically. Forensic toxicology is a hybrid of analytical chemistry and fundamental toxicologic principles.[1]Though there are lot of substances that are poisonous, the people use those substances that are easily available and are in common usage like pesticides, rodenticides and corrosives.

Arising out of a growing concern over the burgeoning incidence of poisoning worldwide, coupled with a lack of public awareness about its seriousness, Poison Information Services made their first appearance in the Netherlands in 1949. In 1961, a telephone answering service on matters pertaining to poisoning was introduced in Leeds, England followed by a National Poisons Information Service at Guy's Hospital London in 1963. Today there are more than 100 such poison control centers around the world. India made a belated foray with establishment of the National Poisons Information Center at the All India Institute of Medical Sciences, New Delhi in December 1994.

Poison control centers provide round the clock toxicity assessment and treatment recommendation over the telephone for all kinds of poisoning situations affecting people of all ages[2].

Poisoning both accidental and intentional is a significant contributor to mortality and morbidity throughout the world. According to WHO, three million acute poisoning cases with 2, 20,000 deaths occur annually. Of these 90% of fatal poisoning occur in developing countries particularly agricultural workers. Acute poisoning forms one of the commonest causes of emergency hospital admissions. Those working in fields and farmers are at higher risk of poisoning due to over the counter availability of pesticides.

MATERIAL AND METHODS

A three year retrospective study of all deaths due to poisoning brought to the mortuary of Osmania General Hospital,

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How to cite this article: Mohammed Abdul Mujeeb Siddiqui, Zahraa Mohammed Siddiqui, Azra Siddiqui3, Katkuri Parvathi. Study to Determine the Common Substances that Caused Deaths due to Ingestion brought for autopsy in Tertiary Care Hospital, Hyderabad, Telangana, India. International Journal of Contemporary Medical Research 2023;10(12):L1-L5.

Hyderabad, Telangana State were taken into consideration. The samples collected from the deaths due to poisoning were sent for analysis to the State Forensic Science Laboratory located in Hyderabad.. The study included the age, sex and the substance used by the deceased due to poisoning in consideration. The reports issued by the Forensic Science Laboratory were observed and recorded to determine the results. In these three years of retrospective study, the statistics related to a total of 1196 autopsies done on deaths due to ingestion of poisonous substances in the Department of Forensic Medicine, Osmania Medical College and Osmania General Hospital, Hyderabad. It was done to know the cause of of deaths due to ingestion of poisonous substance year wise. The data for three years were collected to analyze the number of deaths due to ingestion of poisonous substance.

Classification of Poisons by Mode of Usage

1. Agrochemicals
2. Drugs of dependence and/or abuse
3. Agents used in conflict warfare
4. Food poisons mollusks, or unwanted weeds and herbs
5. Pesticide is a compound that is used to kill pests which may be insects, rodents, fungi, nematodes, mites, ticks,

Classification of Pesticides:

1. Insecticides: Compounds which kill or repel insects- Organophosphates, carbamates, organochlorines, pyrethroids, neonicotinoids
2. Rhodenticides: Compounds which kill rats, mice and other rhodents- Anticoagulants, phosphorus,cholecalciferol, bromethalin, strychnine, zinc phosphide
3. Herbicides: Compounds which kill weeds- Acrolein, paraquat, diquat, atrazine, chlorophenoxy compounds
4. Fungicides: Compounds which kill fungi and moulds- thiocarbamates, captan, captafol, sodium azide
5. Nematicides: Compounds which kill nematodes (worms)-Ethylene dibromide
6. Acaricides: Compounds which kill mites, ticks and spiders- Azobenzene, chlorobenzilate, kelthane
7. Molluscicides: Compounds which kill mollusks such as snails and slugs-Metaldehyde
8. Miscellaneous Pesticides: Compounds of lead, copper, mercury, nicotine, hydrogen cyanide, methyl bromide, naphthalene, dinitrophenol, dinitrocresol, chlorfenson, chloralose

Mode of Action

■ Organophosphates are powerful inhibitors of acetylcholinesterase which is responsible for hydrolysing acetylcholine to choline and acetic acid after its release and completion of function (i.e. propagation of action potential). As a result, there is accumulation of acetylcholine with continued stimulation of local receptors and eventual paralysis of nerve or muscle.

■ Although organophosphates differ structurally from acetylcholine, they can bind to the acetylcholinesterase molecule at the active site and phosphorylate the serine moiety. When this occurs, the resultant conjugate is infinitely more stable than the acetylcholine-acetylcholinesterase conjugate, although endogenous hydrolysis does occur. Depending on the amount of stability and charge distribution, the time to hydrolysis is increased. Phosphorylated enzymes degrade very slowly over days to weeks, making the acetylcholinesterase essentially inactive.

■ Once the acetylcholinesterase is phosphorylated, over the next 24 to 48 hours an alkyl group is eventually lost from the conjugate, further exacerbating the situation. As this occurs, the enzyme can no longer spontaneously hydrolyse and becomes permanently inactivated[3].

RESULTS

The results were concluded based on the reports received from the State Forensic Science Laboratory, Hyderabad after analysis. Out of the total 15138 cases that came for autopsy for three years starting January 2012 to December 2014 in the mortuary of the Osmania General Hospital 1196 number of cases were of deaths due to ingestion of poison comprising 7.9 percentages of total autopsies done. The average age 21 to 30 years comprised major group involved in deaths due to poisoning followed by 31 to 40 years age group. Table 1 shows the number of deaths due to poisonings. Table 2

Figure-1: Packet of pesticide ingested

Figure-2: Container of juice used to ingest pesticide

Year	Poison ingestion cases
2012	445
2013	373
2014	378
Total	1196

Table-1: Year wise cases of deaths due to ingestion of poisonous substance

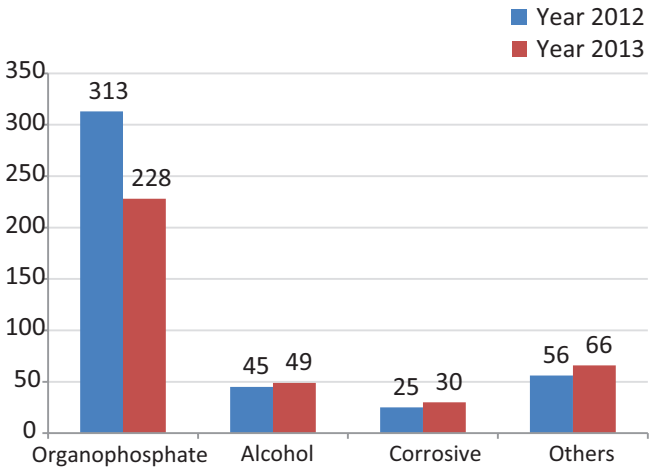
Figure-3: Presence of pesticide in oral cavity

Figure-4: Presence of pesticide granules in stomach

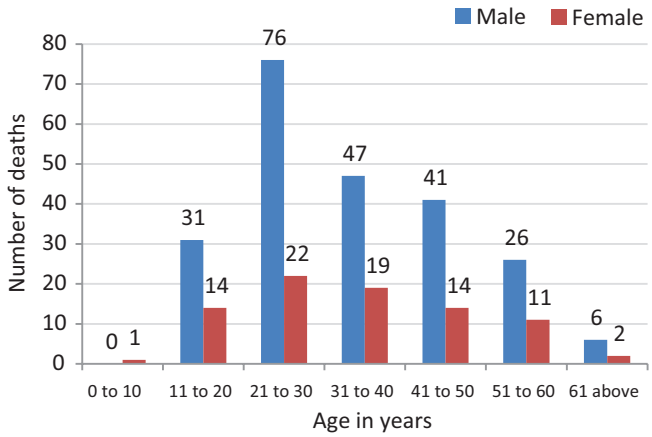
shows the distribution of male and females cases that died due to poisonings and table 3 shows the number of various substances that were the cause of deaths due to poisoning.

DISCUSSION

In the hospital, the emergency department doctor must know how to identify the cases with ingestion of the poisonous substance. Usually the attendants bring the container or the packet containing the ingested substance along with the victim. While conducting the postmortem examination of dead person in autopsy room due to poisoning, the doctor should be aware of the differences between the presence of different poisonous substances. The different areas on6 clothes and person should be examined for the presence of suspected poisonous substance. The color and odor on the clothes should be noted and photographed as an evidence to be presented in the court of law. The present study shows that most of the cases belong to age group 19-29 years which constitute 47.6% because this is the most active age group involved in agricultural and outdoor activities. Antidotes for Organophosphates Atropine Mode of action : Blocks the muscarinic manifestations of organophosphates. However, since atropine affects only the postsynaptic muscarinic receptors, it has no effect on muscle weakness or paralysis Diagnostic dose: Organophosphate-poisoned patients are generally tolerant to the toxic effects of atropine (dry mouth, rapid pulse, dilated pupils, etc.) If these findings occur following a diagnostic atropine dose, the patient is probably



Graph-1: Substance wise distribution of deaths due to poisoning for two consecutive years



Graph-2: Age and sex wise deaths due to organophosphates poisoning in the year 2012

not seriously poisoned Diagnostic dose—Adult: 1 mg intravenously or intramuscularly; Child—0.25 mg (about 0.01 mg/kg) intravenously or intramuscularly Therapeutic dose: 1 to 2 mg IV or IM (adult); 0.05 mg/kg IV (child); every 15 minutes until the endpoint is reached, i.e. drying up of tracheobronchial secretions. Pupillary dilatation and tachycardia are not reliable indicators of the endpoint Atropine can also be administered as an IV infusion after the initial bolus dose, at a rate of 0.02 to 0.08 mg/kg/hr. Once the endpoint has been reached, the dose should be adjusted to maintain the effect for at least 24 hours Atropinisation must be maintained until all of the absorbed organophosphate has been metabolised. This may require administration of 2 to 2,000 milligrams of atropine over several hours to weeks Atropine therapy must be withdrawn slowly to prevent recurrence or rebounding of symptoms, often in the form of pulmonary oedema. This is especially true of poisonings from lipophilic organophosphates such as fenthion Precautions:

• Many parenteral atropine preparations contain benzyl alcohol or chlorobutanol as preservatives. High-dose therapy with these preparations may result in benzyl alcohol or chlorobutanol toxicity. Preservative-free atropine preparations are available, and should be used if large doses are required

• The half-life of atropine is significantly longer in children under 2 years and adults over 60; the rate of administration in these patients should be adjusted accordingly
• Effects of overdosing with atropine include fever, warm dry skin, inspiratory stridor, irritability, and dilated and unresponsive pupils Adverse effects : Atrial arrhythmias, AV dissociation, multiple ventricular ectopics, photophobia, raised intraocular pressure, hyperpyrexia, hallucinations, and delirium Pralidoxime (Pyridine-2-aldoxime methiodide; 2-PAM) Structurally, pralidoxime is 2-hydroxyiminomethyl-1-methyl pyridinium chloride Mode of action: It is usually given along with atropine. Pralidoxime competes for the phosphate moiety of the organophosphorus compound and releases it from the acetylcholinesterase enzyme, thereby liberating the latter and reactivating it While it is advisable to begin pralidoxime therapy within 48 hours of poisoning, it can be administered even much later with beneficial effects. Till recently, pralidoxime was said to be contraindicated in carbamate poisoning because experiments with carbaryl (Sevin) suggested a worsening of symptoms when it was administered. However, recent studies have pointed out that while pralidoxime is not a necessary adjunct to atropine in carbamate overdose, it may be beneficial in some cases Dose: For adults—1 to 2 gm in 100 to 150 ml of 0.9% sodium chloride, given IV over 30 minutes This can be repeated after 1 hour, and subsequently every 6 to 12 hours, for 24 to 48 hours.

Hydrocarbons and Pesticides

Alternatively, a 2.5% concentration of pralidoxime can be given as a loading dose followed by a maintenance dose Serious intoxication may require continuous infusion of 500 mg/hr in adults. Many workers feel that this high dose therapy minimises the incidence of complications such as the Intermediate Syndrome Maximum dose should not exceed 12 gm in a 24 hour period. Infusion over a period of several days may be necessary and is generally well tolerated The WHO currently recommends an initial bolus of at least 30 mg/kg, followed by an infusion of more than 8 mg/kg /hr It is estimated that a plasma concentration of at least 4 mg/L may be necessary for pralidoxime to be effective For children—20 to 40 mg/kg to a maximum of 1 gm/dose given IV, and repeated every 6 to 12 hours for 24 to 48 hours Alternatively, iv infusion can be resorted to, at a rate of 9 to 19 mg/kg/hr Adverse effects: Rapid administration can cause tachycardia, laryngospasm, and even cardiac or respiratory arrest Other adverse effects include drowsiness, vertigo, headache, and muscle weakness It is generally not advised for the treatment of carbamate overdose, especially carbaryl In cases where intravenous administration is not possible, pralidoxime can be given intramuscularly as an initial dose of 1 gram or up to 2 grams in cases of very severe poisoning In some countries obidoxime is used instead of pralidoxime, though it does not appear to be superior to the latter It is apparently favoured over pralidoxime in clinical practice in Belgium, Israel, The Netherlands, Scandinavia, and Germany, and is the only oxime available in Portugal A few investigators suggest that oximes have only a limited role in organophosphate poisoning, and successful management is possible without employing them at all, though this view is not shared by most other workers in the field Diazepam Some studies indicate that the addition of diazepam to atropine and 2-PAM improves survival. It reduces the risk of seizure-induced brain and cardiac damage Dose: For adults—5 to 10 mg IV slowly, every 15 minutes, upto a maximum of 30 mg For children—0.25 to 0.4 mg/kg IV slowly, every 5 to 10 minutes, upto a maximum of 10 mg If diazepam is ineffective, phenytoin or phenobarbitone can be used instead[3]

CONCLUSION

Prevalence of deaths due to ingestion of poisonous substances is higher in the rural areas when compared to urban areas In our study most of the individuals who died due to ingestion of poisonous substance were young men from rural/agricultural background who consumed organophosphate compounds predominantly. When the deaths, due to ingestion of the poisonous substance is brought for autopsy the dead body was examined externally for stains of poisonous substance on clothes and person. In most of the cases the clothes examined showed the stains of the substance ingested due to vomiting. Upon cutting open of the stomach the odor and presence of the substance ingested was detected. The specimens were collected in three containers with sodium chloride and sent to Forensic Science Laboratory to confirm. Analysis of the reports from the Forensic Science Laboratory confirmed the presence of suspected poisonous substance as organophosphates along with other less prevalent substances like alcohol, corrosives and phosphides. More centres of poison information and counseling should be established for educating the people about the dangers and toxicity of the poisons. Since pesticides are easily available in our country so in order to check their accessibility, stringent rules and regulations should be implemented. As it is clear in our study that most affected population is of youngsters so it is the need of hour to give them proper psychological counseling which will decrease the risk in future as well as morbidity. To create awareness among the public various health programs should be conducted about the fatal effects of pesticides and common household cleaning agents along with its useful applications. Prevalence of deaths due to ingestion of poisonous substance is higher in rural areas when compared to the urban areas. After examining victim of poison ingestion, we can identify whether the substance taken was poisonous or non-poisonous. The presence of ingested substance on the clothes and person indicates to some extent its nature.

From the substance wise data of three years from January 2012 to December 2014 for deaths due to ingestion of poisonous substances that were brought to the mortuary of Osmania General Hospital, Hyderabad, it can be concluded that usually there is increase in incidents of deaths due to organophosphates, the common pesticide used in fields by farmers. The pattern in number of deaths is somewhat similar in 2012, 2013 and 2014.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 22-10-2023; **Accepted:** 26-11-2023; **Published:** 31-12-2023